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Air gap spinning process for aramids

Description of Technology: An improved process for spinning aramids from solution using the air gap wet spinning method involves using a coagulant that contains 1 to 1000 ppm by weight of an organic polymer that acts as a drag reducer. Improved productivity and/or finer aramid fibers is obtained with no deterioration of fiber physical properties..

Patent Listing:

1. **US Patent No. 5,393,477,** Issued on February 28, 1995, "Air gap spinning process for aramids"
http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=5393477.PN.&OS=PN/5393477&RS=PN/5393477

Market Potential: This process is particularly useful for spinning aramid fibers. Preferred aramids are those that form lyotropic solutions, and an especially preferred aramid is poly(p-phenylene terephthalamide). A preferred aramid solution is poly(p-phenylene terephthalamide) dissolved in sulfuric acid.

The coagulant described herein also contains a drag reducing polymer. By a drag reducing polymer is meant a polymer which reduces the frictional force between the polymer solution and an object moving with respect to that solution, such as the solution flowing through a pipe, or a fiber being pulled through the solution. Such polymers, their properties, and tests for drag reduction, are known in the art, see for instance J. W. Hoyt in H. Mark, et al. Ed., Encyclopedia of Polymer Science and Engineering, vol. 5, 3rd Ed., p. 129-151 (1986), which is hereby included by reference. As explained in this reference, the higher the molecular weight of the polymer, the more effective the polymer is as a drag reducer. Therefore, it is preferred if the (number average) molecular weight of the polymer is at least 200,000, more preferably at least 500,000, and especially preferably at least 1,000,000.

Use of the drag reducing polymer allows the polymer solution exiting the spinneret to be more highly drawn (higher SSF), resulting in a capacity increase for the spinning apparatus if a spinneret with larger holes is used, or allowing finer (lower diameter) fibers to be made at the same spin rates using the original spinneret. By capacity is meant the weight of aramid fiber produced per unit time. Finer aramid fibers are particularly useful in garments, such a bullet proof garment or fire fighter's coats, where they are more comfortable because they more readily conform to body shape and movement.

Benefits:

- Possibility for a capacity increase for the spinning apparatus.
- Allows finer fibers to be made at equal spin rates as inferior fibers.

Applications:

- Bullet proof, fire fighters', and other garments.

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